Claims:

1. A method for removing a by-product from a chemical hydride solution, the by-product being produced in a reactor configured to contact the chemical hydride solution with a catalyst, the method comprising the steps of:

a) withdrawing at least a portion of the chemical hydride solution at a first temperature from the reactor;

b) cooling the portion of the chemical hydride solution to a second temperature below the first temperature, wherein a precipitate is formed from at least a portion of the by-product;

c) removing at least a portion of the precipitate from the portion of the chemical hydride solution;

d) heating the portion of the chemical hydride solution to a third temperature above the second temperature, wherein a remaining portion of the precipitate is dissolved in the portion of the chemical hydride solution; and

e) delivering the portion of the chemical hydride solution back to the reactor.

2. The method of claim 1, wherein step (c) comprises removing the portion of precipitate from the portion of the chemical hydride solution with a filter.

3. The method of claim 2, that includes providing the filter as a cross-flow membrane filter.

4. The method of claim 1, wherein step (c) comprises removing the portion of precipitate from the portion of the chemical hydride solution with a centrifuge.

5. The method of claim 2, that includes providing a gravity settling tank upstream of the filter, to assist with removing the portion of the precipitate.

6. The method of claim 1, wherein the first temperature is approximately in the range of 30°C to 60°C.

7. The method of claim 6, wherein the first temperature is approximately 50°C.

8. The method of claim 6, wherein the second temperature is approximately in the range of 15°C to 45°C.

9. The method of claim 8, wherein the second temperature is approximately 20°C.

10. The method of claim 6, wherein the third temperature is approximately in the range of 25°C to 55°C.

11. The method of claim 10, wherein the third temperature is approximately 35°C.

12. The method of claim 1, that includes cooling the portion of the chemical hydride solution in a heat exchanger to an intermediate temperature, lower than the first temperature, but higher than the second temperature, and further cools the portion of the chemical hydride solution to the second temperature in a radiator downstream of the heat exchanger.

13. The method of claim 12, wherein the intermediate temperature is approximately in the range of 25°C to 55°C.

14. The method of claim 13, wherein the intermediate temperature is approximately 35°C.

15. The method of claim 12, that includes delivering the portion of the chemical hydride solution back through the heat exchanger to heat the portion of the chemical hydride solution to the third temperature.

16. The method of claim 1, that includes cooling the portion of the chemical hydride solution to the second temperature in a radiator, and heating

the portion of the chemical hydride solution to the third temperature in a heater.

17. The method of claim 1, wherein step (c) comprises removing approximately 50% to 100% of the precipitate.

18. The method of claim 17, wherein step (c) comprises removing approximately 80% of the precipitate

19. A system for removing a by-product from a chemical hydride solution, the system comprising a circuit including:

a) a reactor including a catalyst for catalyzing reaction of the chemical hydride solution to generate hydrogen;

b) a pump for withdrawing at least a portion of the chemical hydride solution at a first temperature from the reactor and returning the portion of the chemical hydride solution to the reactor;

c) a cooling means for cooling the portion of the chemical hydride solution to a second temperature below the first temperature, wherein a precipitate is formed from at least a portion of the by-product, the cooling means being located in the circuit downstream of the reactor;

d) a separating means for removing at least a portion of the precipitate from the portion of the chemical hydride solution, the separating means being located in the circuit downstream of the cooling means; and

e) a heating means for heating the portion of the chemical hydride solution to a third temperature above the second temperature, wherein a remaining portion of the precipitate is dissolved in the portion of the chemical hydride solution, the heating means being located in the circuit downstream from the separating means.

20. The system of claim 19, wherein at least a part of the cooling means and at least a part of the heating means are provided by a heat exchanger, the heat exchanger having one side located in the circuit downstream of the separating means and another side located in the circuit downstream of the reactor, thereby to transfer heat from the chemical hydride

solution leaving the reactor to the chemical hydride solution flowing toward the reactor, and wherein the cooling means additionally comprises a radiator and a cooling fan.

21. The system of claim 20, wherein the heat exchanger is adapted to cool the chemical hydride solution to an intermediate temperature between the first temperature and the second temperature.

22. The system of claim 20, wherein the heat exchanger comprises a plate and frame heat exchanger.

23. The system of claim 21, wherein the radiator and cooling fan are adapted to cool the chemical hydride solution to the second temperature.

24. The system of claim 23, further comprising an upstream temperature sensor located upstream of the radiator, a downstream temperature sensor located downstream of the radiator, and a control means for controlling the cooling fan, wherein the upstream and downstream temperature sensors being adapted to measure the temperature of the chemical hydride solution and communicate the temperature to the control means.

25. The system of claim 24, wherein the upstream sensor is located between the heat exchanger and the radiator, and the downstream sensor is located between the radiator and the separating means.

26. The system of claim 24, further comprising a mass flow controller located upstream of the heat exchanger and electrically connected to the control means, the mass flow controller being adapted to control the flow rate of the chemical hydride solution into the heat exchanger.

27. The system of claim 19, wherein the catalyst is selected from one or more members of the group comprising ruthenium, cobalt, and platinum.

28. The system of claim 27, wherein the catalyst is in the form of a foam.

29. The system of claim 19, wherein the reactor comprises a gas liquid separator.

30. The system of claim 19, wherein the separating means comprises a gravity settling vessel

31. The system of claim 30, wherein the separating means further comprises a filter located downstream of the gravity separator vessel.

32. The system of claim 31, wherein the filter is selected from a crossflow filter, a plate and frame filter, a leaf filter, and a belt filter.

33. The system of claim 19, wherein the heating means comprises a heater.

34. The system of claim 19, wherein the cooling means is selected from one or more members of a group comprising a refrigeration unit, a heat pump, and a Peltier junction.